

What is claimed is:

1. A surface acoustic wave (SAW) resonator comprising:
 - a piezoelectric substrate;
 - an interdigital transducer (IDT) electrode formed on said piezoelectric
 - 5 substrate; and
 - a reflector electrode disposed adjacent to said IDT electrode,
 - wherein said IDT electrode comprises a plurality of first finger-electrodes, a plurality of second finger-electrodes and a plurality of strip-line electrodes, and
 - 10 wherein said first finger-electrodes and said second finger-electrodes do not overlap with each other, but are acoustically coupled together by said strip-line electrodes.
2. The SAW resonator of claim 1, wherein said IDT electrode further
- 15 comprises:
 - a first bus-bar electrode coupled to said first finger-electrodes;
 - a second bus-bar electrode coupled to said second finger-electrodes,
 - wherein said strip-line electrodes overlap with at least one of said first finger-electrodes and said second finger-electrodes,
 - 20 wherein said IDT electrode and said reflector electrode form at least two resonating units, and
 - wherein said at least two resonating units are coupled in series via said strip-line electrodes.
- 25 3. The SAW resonator of claim 2, wherein said first finger-electrodes and said second finger-electrodes are arranged in a face-to-face manner.

4. The SAW resonator of claim 1,
wherein said first finger-electrodes are respectively arranged at
intervals of a propagation wavelength of the SAW,
wherein said second finger-electrodes are respectively arranged at
5 intervals of a propagation wavelength of the SAW, and
wherein said first finger-electrodes are arranged to directly face said
second-finger electrodes along a propagating direction of the SAW.

5. The SAW resonator of claim 1,
10 wherein said first finger-electrodes are respectively arranged at
intervals of a propagation wavelength of the SAW,
wherein said second finger-electrodes are respectively arranged at
intervals of a propagation wavelength of the SAW, and
wherein said first finger-electrodes and said second finger-electrodes
15 are respectively arranged to face each other and to deviate from each other by
a given distance along a propagation direction of the SAW.

6. The SAW resonator of claim 5, wherein the given distance is one of
 $\lambda/2$ and $\lambda/4$, where λ is the propagation wavelength of the SAW.
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7. The SAW resonator of claim 4, wherein said strip-line electrodes are
disposed with a deviation of $\lambda/2$, where λ = a wavelength of the SAW, from
respective centers of said first finger-electrodes and said second finger-
electrodes.
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8. The SAW resonator of claim 7,
wherein a first area, where said first finger-electrodes and said strip-

line electrodes overlap with each other, forms a first resonating unit, and
 wherein a second area, where said second finger-electrodes and said
 strip-line electrodes overlap with each other, forms a second resonating unit.

5 9. The SAW resonator of claim 5, wherein said strip-line electrodes are
 separated from said first finger-electrodes and said second finger-electrodes
 respectively with substantially equal spaces in between, and wherein each
 one of said strip-line electrodes is shaped like a dogleg.

10 10. The SAW resonator of claim 2, wherein said strip-line electrodes
 comprise electrodes ranging from a plurality of first strip-line electrodes to a
 plurality of "N"th strip-line electrodes, wherein N is an integer not less than
 2,

 wherein respective parts of said first strip-line electrodes are disposed
 15 to overlap with said first finger-electrodes with a deviation of $\lambda/2$, where λ =
 a wavelength of the SAW, from respective centers of each one of said first
 finger-electrodes, and

 wherein respective parts of said "N"th strip-line electrodes are
 disposed to overlap with said second finger-electrodes with a deviation of $\lambda/2$
 20 from respective centers of each one of said second finger-electrodes.

 11. The SAW resonator of claim 10, wherein an extension of said first
 strip-line electrodes, said second strip-line electrodes, a plurality of "m"th
 strip-line electrodes, a plurality of "m+1"th strip-line electrodes, wherein "m"
 25 is an integer not less than 2, and not more than $N - 2$, a plurality of " $N - 1$ "th
 strip-line electrodes, and an extension of said "N"th strip-line electrodes
 overlap with each other in a given length;

wherein a first area, where said first finger-electrodes and said first strip-line electrodes overlap with each other, forms a first resonating unit;

wherein a second area, where said second finger-electrodes and said Nth strip-line electrodes overlap with each other, forms a second resonating unit;

wherein a plurality of additional areas, where electrodes ranging from said "m"th strip-line electrodes to said "m+1"th strip-line electrodes overlap with each other respectively in a given length, form "N + 1" resonating units; and

wherein said first resonating unit through said "N + 1"th resonating unit are coupled in series via said first strip-line electrodes through said "N"th strip-line electrodes.

12. The SAW resonator of claim 10, wherein $N = 2$, and at least one of said first strip-line electrodes and said second strip-line electrodes is shaped like a dogleg.

13. The SAW resonator of claim 2, further comprising a plurality of dummy electrodes respectively disposed between said first finger-electrodes and said second finger-electrodes such that each of said dummy electrodes faces a respective one of said strip-line electrodes.

14. The SAW resonator of claim 13, wherein each of said dummy electrodes has a length of not less than $\lambda/2$, where λ = a wavelength of the SAW.

15. The SAW resonator of claim 13, wherein each of said dummy

electrodes faces a respective one of said strip-line electrodes with a space in-between of not more than $\lambda/4$, where λ = a wavelength of the SAW.

16. The SAW resonator of claim 13, wherein each of said dummy
5 electrodes has a width greater than that of each of said first finger-electrodes and that of each of said second finger-electrodes.

17. A surface acoustic wave (SAW) filter comprising:
a piezoelectric substrate; and
10 a plurality of resonating units disposed on said piezoelectric substrate, wherein at least a part of said plurality of resonating units includes an interdigital transducer (IDT) electrode having a first finger-electrode, a second finger-electrode, and a strip-line electrode,
wherein said first finger electrode and said second finger electrode do
15 not overlap with each other but are acoustically coupled together by said strip-line electrode.

18. A surface acoustic wave (SAW) filter comprising:
a piezoelectric substrate;
20 a plurality of interdigital transducer (IDT) electrodes disposed on said piezoelectric substrate adjacent to each other along a propagating direction of the SAW;
a first reflector electrode disposed at a first side of said plurality of IDT electrodes; and
25 a second reflector electrode disposed at a second side of said plurality of IDT electrodes,
wherein at least one of said IDT electrodes includes a first finger-

electrode, a second finger-electrode and a strip-line electrode, and

wherein said first finger-electrode and said second finger-electrode do not overlap with each other but are acoustically coupled together by said strip-line electrode.

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19. The SAW filter of claim 18, wherein said plurality of IDT electrodes includes a first IDT electrode, a second IDT electrode, and a third IDT electrode,

wherein said second IDT electrode is disposed between said first IDT electrode and said third IDT electrode, and includes said first finger-electrode, said second finger-electrode and said strip-line electrode,

wherein said first finger-electrode and said second finger-electrode do not overlap with each other but are acoustically coupled together by said strip-line electrode,

15 wherein each of said first IDT electrode and said third IDT electrode are formed of two IDT electrode patterns coupled together in parallel.

20. An antenna duplexer comprising a plurality of surface acoustic wave (SAW) filters, wherein each of said plurality of SAW filters includes:

20 a piezoelectric substrate; and

a plurality of SAW resonators disposed on said piezoelectric substrate;

wherein each of said plurality of SAW resonators includes an interdigital transducer (IDT) electrode,

wherein, for each of said SAW resonators, said IDT electrode includes a first finger-electrode, a second finger-electrode facing said first finger-electrode, and a strip-line electrode, and

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wherein, for each of said SAW resonators, said first finger-electrode

and said second finger-electrode are acoustically coupled together by said strip-line electrode.